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## Memorandum

*To: Chris Lichens - USEPA*

*From: Sharon Wallin, P.G. - CDM  
Ravi Subramanian, P.E. - CDM*

*Date: August 31, 2006*

*Subject: Proposed Groundwater Extraction and Treatment Pilot Test  
Omega Chemical Superfund Site  
10500-53426  
10500-5.2.3*

### 1.0 Introduction

Camp Dresser & McKee Inc. (CDM) has prepared this technical memorandum (TM) on behalf of the Omega Chemical Site Potentially Responsible Party (PRP) Organized Group (OPOG). This TM provides USEPA with the scope of work for pilot testing the recently installed extraction wells at the Omega Chemical Site (the Site). Pilot testing will consist of groundwater extraction, air stripping and off-gas treatment using Vapor Phase granular activated carbon (VPGAC) adsorption. The pilot test will confirm expected groundwater extraction rates, the expected effectiveness of groundwater and off-gas treatment, and assist in the design and implementation of a potential full-scale groundwater extraction and treatment system at the Site. Pilot testing is scheduled to be conducted during the period September 11 through October 6, 2006, with a draft summary technical memorandum scheduled for submittal to USEPA on November 3, 2006.

### 1.1 Proposed Groundwater Treatment Technology Description

Based on treatability testing conducted to date and the anticipated sanitary sewer discharge limits for the treated water, air stripping combined with off-gas treatment is planned for treatment of extracted groundwater at the Site. The results of the treatability study will be submitted to USEPA as part of the November 3, 2006 Pilot Testing Summary Technical Memorandum.

Air stripping is a conventional treatment technology that involves active mixing of ambient air with contaminated groundwater to strip volatile contaminants from groundwater into the air. Typical air stripper configurations include shallow tray systems and packed tower systems. Air strippers produce an off-gas stream that typically requires treatment prior to

discharge to the atmosphere. VPGAC adsorption of the off-gas is planned to be used in conjunction with the air stripper. In this technology, VPGAC contained in a vessel is used to remove contaminants from air by the process of physical adsorption. Contaminants vary in their ability to be effectively adsorbed to VPGAC. Tetrachloroethene (PCE) is anticipated to be the primary risk driver for air stripper off-gas treatment and is efficiently adsorbed by GAC.

In addition to PCE, other strippable contaminants that may be present in extracted groundwater include 1,1,1-trichloroethane, 1,1,2-trichloroethane, 1,1,2-trichlorotrifluoroethane, 1,1-dichloroethane, 1,1-dichloroethene, 1,2-dibromo-3-chloropropane, 1,4-dichlorobenzene, 1,2-dichloroethane, benzene, bromomethane, carbon tetrachloride, chlorobenzene, chloroform, dichlorodifluoromethane, ethyl benzene, methylene chloride, methyl tertiary butyl ether, naphthalene, o-xylene, p-xylene, toluene, trichloroethene, trichlorofluoromethane, and vinyl chloride. Several of these VOCs such as methylene chloride, chloroform, and the chlorofluoromethanes and ethanes (i.e., freons) are poorly adsorbed to GAC. Preliminary risk modeling for potential air emissions has demonstrated that these other VOCs represent a minor component of the total risk relative to that posed by PCE.

## 1.2 Pilot Test Objectives

The overall objectives of the proposed pilot test are to collect additional data which will be used in the final design and implementation of the groundwater treatment remedy for the Site. Specifically, the collected data will aid in selecting the most appropriate design parameters for a full-scale system at the Site.

Specific objectives for this pilot test include:

- Determine sustainable groundwater extraction rates from newly installed extraction wells and characterize extracted groundwater with respect to contaminants of concern and general groundwater chemistry.
- Confirm the ability of air stripping to reduce total VOC concentrations in extracted groundwater to less than 1,000 micrograms per liter ( $\mu\text{g/L}$ ) as required for disposal to the Joint Water Pollution Control Plant (JWPCP) in Carson operated by the Los Angeles County Sanitation District (LACSD).
- Obtain VPGAC influent and effluent VOC concentration data to support air emission risk modeling that will be required to meet the substantive requirements of the California South Coast Air Quality Management District (SCAQMD).
- Develop preliminary estimates for the VPGAC consumption rates.

## **2.0 Pilot Test Design and Procedures**

This section describes the wells and the equipment that will be used to perform and monitor the pilot testing. All work will be performed in accordance with the procedures detailed in this document.

### **2.1 Aquifer Testing Procedures**

Five extraction wells (EW1 through EW5) were installed along Putnam Street at the locations illustrated on Figure 2-1 during July 2006. Well construction details are provided on Table 2-1.

For aquifer testing purposes, submersible test pumps and 3/4-inch diameter PVC sounding tubes will be installed in the five wells (EW1 through EW5) by the drilling subcontractor (WDC). Prior to the initiation of testing, down-hole automatic data loggers (Trolls) will be installed by CDM in 7 observation wells/piezometers (OW2, OW3, OW3b, OW8, OW8b, PZ1, and PZ2). Manual drawdown and recovery measurements will also be collected from the five extraction wells and three observation wells (OW1, OW4, and OW4b). All five wells will be pumped concurrently for approximately four hours, to determine an appropriate rate and settings for the long-term (approximately 20 to 24 hours) test pumping which will follow.

Based on observations and water level measurements made during development, it is anticipated that EW1 and EW2 will be pumped during the long-term test at approximately 8 to 10 gallons per minute (gpm). Well EW3 will likely be pumped at approximately 6 to 8 gpm, and EW4 and EW5 will each be pumped at approximately 3 gpm. Anticipated total pumping from all five wells, therefore, will likely be in the range of 28 to 34 gpm.

Water levels prior to initiating each test and during the pumping and recovery phases of each test will be monitored automatically using a data logger and transducer, and manually (at OW1, OW4, and OW4b) using an electric water level indicator. Manual water level readings at OW1 (the well closest to the extraction wells) will be collected on a typical logarithmic progression (e.g., every minute during the first ten minutes of the test, every two minutes from 10 to 20 minutes into the test, every 5 minutes from 20 to 30 minutes into the test, every 10 minutes from 30 to 60 minutes into the test, etc.). Manual water level measurements will be collected from the five extraction wells approximately every hour and from observation wells OW4 and OW4b approximately every two hours, as time allows. The down-hole data loggers will also collect water level measurements from the seven observation wells/piezometers (OW2, OW3, OW3b, OW8, OW8b, PZ1, and PZ2) using a pre-set logarithmic progression.

The pumping rate will be measured using an in-line flowmeter and totalizer. The volume of water pumped during each test and the time pumped will be noted. Periodically during

pumping, samples of the discharge water will be collected for field measurement of pH, temperature, electrical conductivity, and turbidity.

Following the termination of pumping, the pumps will be allowed to remain undisturbed in the wells for a minimum of four hours while recovery water level measurements are collected. It is anticipated that manual and datalogger measurements will be collected from all observation wells for approximately 12 hours following termination of pumping. Upon the completion of testing, the data will be analyzed to provide estimates of hydraulic conductivity at the tested locations. The suitability of the wells for proposed groundwater extraction and proposed pumping rates for each well will also be evaluated.

All purge water will be contained on-site in two 21,000 gallon portable tanks, with a combined capacity of approximately 42,000 gallons. Constant discharge testing will be performed for approximately 20 to 24 hours, or until the two tanks have been filled to capacity. The purge water contained in the two tanks will be treated using the pilot testing technology described in below.

## **2.2 Pilot Test Process Equipment**

Figure 2-2 shows a schematic of the process equipment that will be used for the pilot test.

Air Stripper - A subcontractor will supply an air stripper package. The air stripper will consist of a shallow tray air stripper unit equipped with a blower and a sump pump for treated water discharge. The proposed model is Shallow Tray Low Profile Air Stripper Model 1300P manufactured by North East Environmental Products, Inc. (NEEPS) rated for flows from 0.5 gallons per minute (gpm) to 15 gpm with air flow rates ranging from 150 standard cubic feet per minute (scfm) to 195 scfm. Appendix A contains a cutsheet of the proposed stripper. The anticipated groundwater flow rate for the pilot test is approximately 15 gpm but may be varied. The anticipated air to water ratio is 75:1 which translates to 150 scfm of air. Air flow on the stripper will be adjusted using a damper as appropriate. A skid mounted transfer pump will be used to pump untreated water from the Baker Tanks through a set of bag filters to remove sediments to the air stripper. All equipment will be operated using one or more single phase generators or onsite power, if available.

Vapor Treatment - VPGAC will be used to treat off gas from the air stripper. Two vessels with 400 to 500 pounds of VPGAC with interconnecting hoses, fittings, and valves will be provided by a subcontractor. These vessels will be operated in series. High relative humidity (RH) and high temperature reduces the adsorption capacity of the carbon. As a result, and since relative humidity depends on the temperature, it is often necessary to determine which combination of temperature and relative humidity is the most cost effective. A good compromise between temperature and humidity is to raise or lower the RH of the stripper off-gas to about 40% to 50%, prior to entering the VPGAC vessels (U.S Army Corps of Engineers, 2001). On full-scale systems, a heat exchanger is typically used to maintain the RH

levels. For the pilot test, a booster blower, with a moisture knockout tank on the suction side of the blower, will be used to increase the temperature to reduce/maintain the RH as close as possible to 50% prior to entering the first GAC vessel. If it is assumed that the vapor leaving the air stripper is saturated with moisture (100% RH), the required temperature rise will need to be about 20°F based on a psychrometric chart. In addition, an in-line heater may be used to heat the air, if the blower does not have the capacity or if additional heating is required due to cooler than anticipated stripper off-gas.

Water Containment - Three 21,000-gallon Baker tanks will be used to contain extracted and treated groundwater. Extracted groundwater will be pumped into Tanks 1 and 2 during the pump test. Groundwater from Tank 1 will then be treated by the air stripper and discharged into Tank 3. After Tank 1 is emptied, groundwater from Tank 2 will be treated by the air stripper and discharged into Tank 1.

### **2.3 Pilot Test Procedures**

The groundwater and vapor treatment pilot test will be conducted immediately after completion of the pump test to minimize volatilization of VOCs from groundwater contained in the Baker tanks. Groundwater flow to the air stripper will be initiated at a flow rate of 15 gpm from Baker Tank 1 to the air stripper and then to Baker Tank 3. Air flow to the air stripper will be initiated at the minimum flow rate of about 150 scfm. The combination of the booster blower and/or in-line heater is expected to have the capacity to provide the appropriate temperature rise required to decrease/ maintain the RH to approximately 40% to 50% at the operating air flow. The operating conditions will be maintained constant until Baker Tank 1 is empty. At that time, the valves will be adjusted to result in groundwater being pumped from Baker Tank 2 through the air stripper and then into Baker Tank 1. The total estimated time for the actual test is approximately two to three days with the actual test running continuously for approximately 48 hours.

## **3.0 Sampling and Analysis**

This section describes the monitoring equipment and monitoring methods that will be used during the pilot testing.

### **3.1 Groundwater Sampling**

Samples for laboratory analysis will be collected from all five wells (including a duplicate) just prior to terminating the pumping portion of the test. The six samples will be analyzed for the following on a standard turnaround basis: VOCs, semi-VOCs, 1,4-dioxane, NDMA (Method 1625C [low detection limit]), Title 22 metals, total organic carbon, biological oxygen demand, chemical oxygen demand, sulfide, chloride, alkalinity, hardness, total dissolved solids, and total and dissolved iron and manganese. In addition, one sample will be collected from each well approximately four hours into the pumping portion of the test and analyzed for VOCs, 1,4-dioxane, and NDMA on a standard turnaround basis. All analysis will be

performed by Test America, a California Department of Health Services (DHS)-certified lab for hazardous waste analysis.

### **3.2 Pilot Test Monitoring and Sampling**

Table 3-1 presents the details of the process monitoring, sampling and analysis to be conducted during the pilot test. Groundwater monitoring will consist of flow measurement using a positive displacement flow meter and totalizer. Groundwater sampling will consist of collecting air stripper influent and effluent samples for off-site laboratory analysis for the compounds listed in Table 3-1.

Vapor monitoring will consist of air flow measurement at the air stripper inlet, and temperature and RH monitoring at the blower/heater inlet and outlet as shown on Figure 2-2. Field monitoring of total VOCs will be performed using an organic vapor analyzer (OVA) equipped with a photoionization detector (PID) or a flame ionization detector (FID) on samples collected in Tedlar bags from the inlet to GAC-1, the inlet to GAC-2, and the outlet from GAC-2. To gather definitive data on the VOC concentrations in vapors, samples will be collected in Summa canisters (1-liter or less) from the vapor sample ports on the inlet to GAC-1, the inlet to GAC-2, and the outlet from GAC-2 and submitted for off Site VOC analysis according to EPA method TO-14A. Some of the initial set of groundwater and vapor samples may be analyzed on a rush turnaround to provide data for the pilot test.

### **3.3 QA/QC Requirements**

This section describes the QA/QC methods that will be used to perform the pilot testing:

Duplicate Samples - Duplicate groundwater and vapor samples will be collected at a minimum frequency of 5 percent (1 for every 20 samples collected) for all samples submitting for offsite analysis.

Trip Blanks - A trip blank consisting of laboratory grade water will be submitted with each shipment of water samples sent to the off site laboratory.

### **3.4 Field Instrument Calibration**

Field equipment will be calibrated in accordance with the manufacture's instructions. Instruments requiring field calibration will be checked and adjusted before and after each day of use. All calibration will be documented in the field data sheets or log book.

## **4.0 Analysis and Interpretation of Test Results**

This section describes the data analysis, interpretation, and reporting methods that will be used in evaluating the pilot test results. The data and measurements collected during pilot testing will provide the following information relevant to groundwater extraction and treatment and off-gas treatment:

- Sustainable groundwater extraction rates from each new extraction well.
- Groundwater characteristics of extracted water including contaminant concentrations and general groundwater quality.
- VOC removal efficiency of the air stripper.
- VOC removal efficiency and breakthrough curves in the VPGAC vessel.
- Effluent VOC concentrations from the VPGAC vessels to support air quality modeling necessary to meet the substantive regulatory requirements of the SCAQMD.

#### **4.1 Data Analysis and Interpretation**

Data collected from the pilot testing will be evaluated as follows to support the objectives of the test:

- Sustainable groundwater extraction rates will be used to design the full-scale groundwater treatment and off-gas treatment system.
- Air stripper groundwater effluent quality will be assessed to determine whether it will meet anticipated permit requirements for discharge to JWPCP/LACSD.
- VPGAC vapor effluent quality data will be used as inputs to an air quality model based on a full-scale system to determine whether the maximum incremental cancer risk (MICR) is less than  $10^{-5}$  and the chronic and acute hazard indices (HIC and HIA) are less than 1.0.
- VOC breakthrough curves for the VPGAC adsorbers will be used to estimate full-scale VPGAC use rates.

#### **4.2 Reporting**

CDM will prepare and submit a Draft Pilot Test Technical Memorandum (TM) to EPA approximately 4 weeks after receipt of the last laboratory data. The TM will contain a summary of the methods used in the testing and any deviations from this TM that occurred during the testing. It will present the results, an interpretation of the results with regard to design, as well as laboratory reports and relevant maps, tables and figures.

### **5.0 Additional Issues**

#### **5.1 Health and Safety**

Health and safety procedures will conform to the existing Site Health and Safety Plan for the site. It is anticipated that the pilot testing can be completed using Level D personal protection.

## 5.2 Permitting

The pilot testing will be performed under substantive compliance with SCAQMD permit requirements for groundwater air stripping in conjunction with two-stage VPGAC treatment. Two-stage VPGAC treatment is considered best available control technology for toxics (T-BACT) by SCAQMD.

## 5.3 Residuals Management

The anticipated residuals from this testing include spent VPGAC and treated groundwater. Spent GAC will be regenerated or disposed of off-site by the vendor. Spent groundwater will be disposed off-site by a licensed waste disposal vendor in accordance with applicable laws and regulations.

## 5.4 Staffing

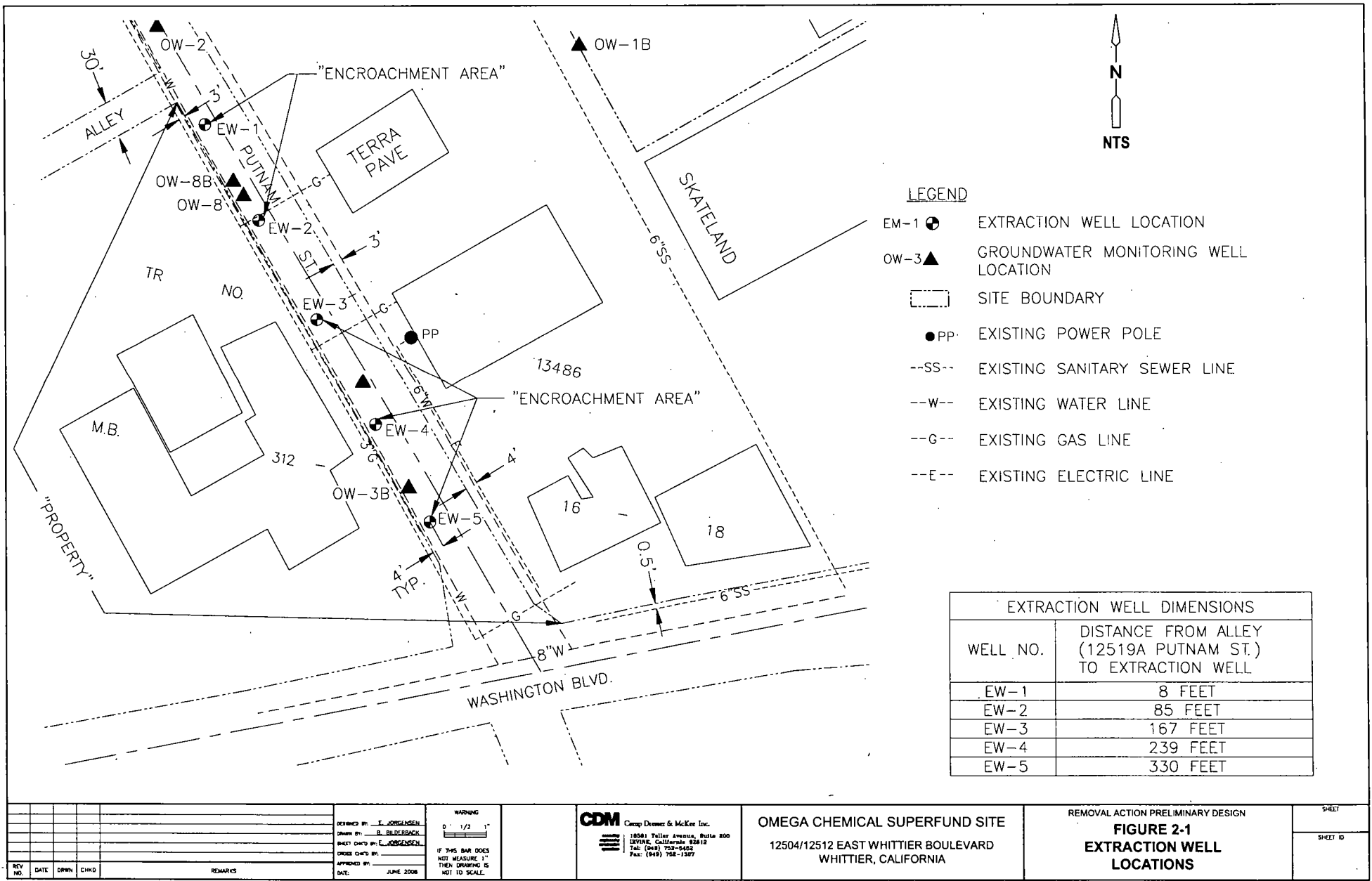
CDM staff will direct the pilot testing with a subcontractor providing equipment and an operator for test startup. Sharon Wallin, P.G. and Ravi Subramanian, P.E. both from the CDM's Irvine office will be project manager and project engineer, respectively. Dave Chamberlin of CDM's Denver office will be the client officer. Michael Smith of the CDM Denver Office and Dr. Pat Evans of CDM Bellevue office will serve as technical experts for aquifer testing and pilot testing portions, respectively, of the work discussed herein, and will also be the lead authors for the pilot test TM.

## 5.5 Schedule

The anticipated Schedule for the pilot test is as follows:

Task	Anticipated Start Date	Anticipated Completion Date
Testing Procedures TM to EPA		August 31, 2006
EPA Review	August 31 2006	September 7, 2006
Extraction Well Aquifer Testing	September 11, 2006	September 15, 2006
Pilot Test	September 18, 2006	September 22, 006
Laboratory Analysis	September 25, 2006	October 6, 2006
Draft Pilot Test TM to EPA	September 25, 2006	November 3, 2006

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REV	NO.	DATE	DRWN	CHKD	REMARKS

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 DRAWN BY: B. BLUESCHNEIDER  
 CHECKED BY: E. JOHNSON  
 APPROVED BY: \_\_\_\_\_  
 DATE: JUNE 2008

WARNING  
 0" 1/2" 1"  
 IF THIS BAR DOES  
 NOT MEASURE 1"  
 THEN DRAWING IS  
 NOT TO SCALE.

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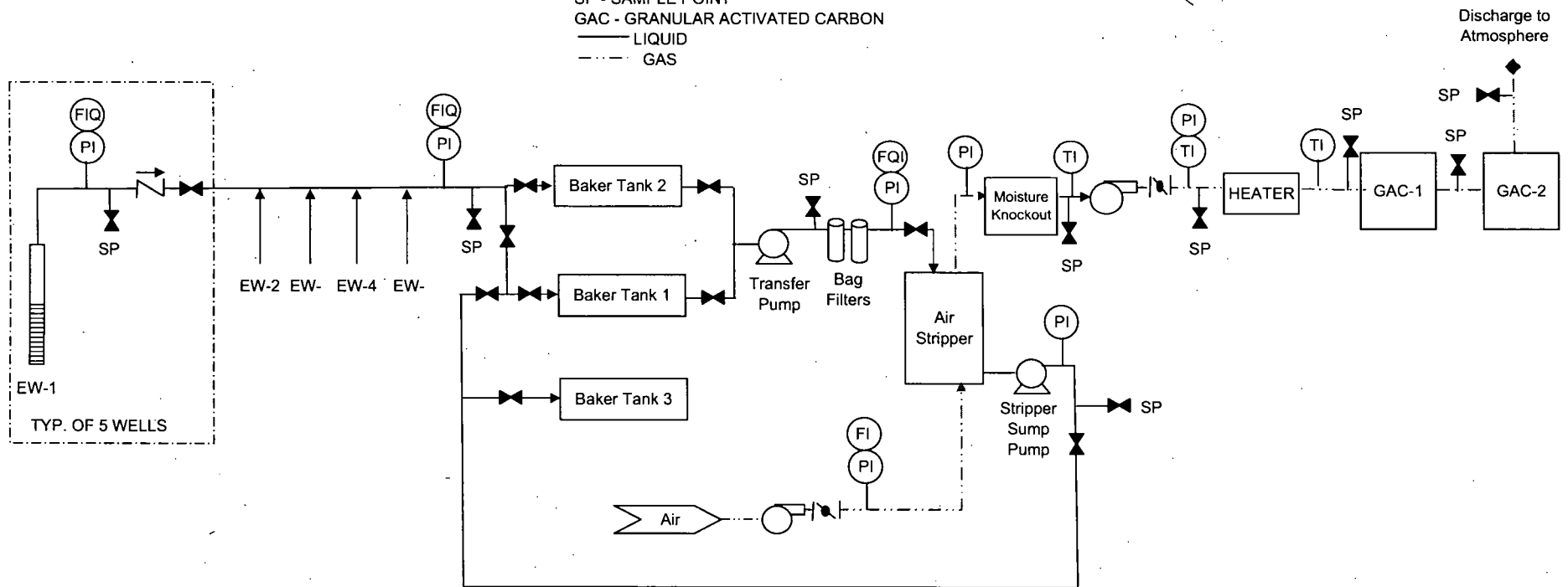
**OMEGA CHEMICAL SUPERFUND SITE**  
 12504/12512 EAST WHITTIER BOULEVARD  
 WHITTIER, CALIFORNIA

REMOVAL ACTION PRELIMINARY DESIGN  
**FIGURE 2-1  
EXTRACTION WELL  
LOCATIONS**

SHEET  
 SHEET ID

# **LEGEND**

EW - EXTRACTION WELL  
 FQI - FLOW INDICATION TOTALIZATION  
 FI - FLOW INDICATION  
 PI - PRESSURE INDICATION  
 TI - TEMPERATURE INDICATION  
 SP - SAMPLE POINT  
 GAC - GRANULAR ACTIVATED CARBON  
 — LIQUID  
 - - - GAS



**CDM**

**OMEGA CHEMICAL SUPERFUND SITE  
 12504/12512 EAST WHITTIER BOULEVARD  
 WHITTIER, CALIFORNIA**

**PILOT GROUNDWATER TREATMENT SYSTEM  
 SCHEMATIC**

**Figure No.  
 2-2**

**Table 2-1.**  
**Omega Chemical Superfund Site**  
**Extraction Well Construction Details**

Well No.	Casing Dia. (inches)	Boring diameter (inches)	TD Drilled (feet bgs)	Blank Casing Type	Screen Type	Screened Interval (feet bgs)	Opening Size (inch)	Filter Pack Gradation	Filter Pack Interval (feet bgs)	Date Drilled	TD Cased (feet bgs)	Northing (feet)	Easting (feet)	Depth to Groundwater* (feet btoc)	Reference Point Depth (feet bgs)	Reference Point (casing)
EW-1	6	12	92	PVC	SS/WW	72 - 87	0.020	#2/12	60 - 92	Jul-06	92	NA	NA	66.66	0.68	top of PVC
EW-2	6	12	92	PVC	SS/WW	72 - 87	0.020	#2/12	60 - 92	Jul-06	92	NA	NA	65.51	0.67	top of PVC
EW-3	6	12	90	PVC	SS/WW	70 - 85	0.020	#2/12	63.4 - 90	Jul-06	90	NA	NA	64.08	0.92	top of PVC
EW-4	6	12	91	PVC	SS/WW	71 - 86	0.020	#2/12	59 - 91	Jul-06	91	NA	NA	63.11	0.70	top of PVC
EW-5	6	12	90	PVC	SS/WW	70 - 85	0.020	#2/12	58.5 - 90	Jul-06	90	NA	NA	61.55	0.56	top of PVC

bgs - below ground surface

msl - feet above Mean Sea Level

GS - Ground Surface

TD - Total Depth

Dia. - Diameter

SS - stainless steel

WW - continuous wire wrap screen

PVC - polyvinylchloride

btoc - below top of casing (measuring point)

\* Depth to groundwater measured July 19, 2006 following well installation and prior to initiating well development.

**Table 3-1**  
**Omega Chemical Superfund Site**  
**Pilot Test Sampling and Monitoring Schedule**

Parameter/Analyte	Location	Minimum Frequency	Total Anticipated Number of Samples/Readings	Onsite Measurement Method	Offsite Analytical Method
VOCs and 1,4-dioxane	Groundwater influent to and effluent from air stripper	2/4 hr period	24	---	EPA Method 8260B and 8260B-SIM
SVOCs	Groundwater influent to and effluent from air stripper	1/test	2	---	EPA 8270C
NDMA	Groundwater influent to and effluent from air stripper	1/test	2	---	EPA 1625C
CAM Title 22 Metals*	Groundwater influent to and effluent from air stripper	1/test	2	---	EPA 6010/7420 or Equal
pH*	Groundwater influent to and effluent from air stripper	2/24 hr period	8	pH probe	---
COD*	Groundwater influent to and effluent from air stripper	1/test	2	---	EPA Method 410.4
Sulfide*	Groundwater influent to and effluent from air stripper	1/test	2	---	EPA Method 376.2
Total suspended solids*	Groundwater influent to and effluent from air stripper	1/test	2	---	EPA Method 160.2
Cyanide*	Groundwater influent to and effluent from air stripper	1/test	2	---	EPA Method 335.2
Oil and grease*	Groundwater influent to and effluent from air stripper	1/test	2	---	EPA Method 413.2
General Chemistry**	Groundwater influent to and effluent from air stripper	1/test	2	---	Various EPA and Standard Methods
Groundwater flow rate & cumulative volume	Groundwater influent to air stripper	2/4 hr period	12	Positive displacement flow meter	---
Total VOCs	GAC-1 influent, GAC-2 influent, GAC-2 effluent	2/4 hr period	36	OVA (samples in Tedlar Bags)	---
VOCs	GAC-1 influent, GAC-2 influent, GAC-2 effluent	2/4 hr period	36	---	EPA Method TO-14A (Summa Canisters)
Temperature	Blower/Heater influent and effluent	2/4 hr period	24	Temperature gauge	---
Relative humidity	Blower/Heater influent and effluent	2/4 hr period	24	Relative humidity meter	---
Air flow rate	Air stripper influent	2/4 hr period	12	Air velocity meter (pitot tube with gage) or venturi-style flow meter	---

**Notes:**

VOCs - Volatile organic chemicals

SVOCs - Semi-volatile organic chemicals

COD - Chemical oxygen demand

OVA - Organic vapor analyzer

\* - Analytes required for Los Angeles County Sanitation District sewer discharge permit

\*\* - Other inorganic analytes required for design